NASA Measurement Summary

WG1
33rd IADC Meeting

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Major Initiatives

- Meter Class Autonomous Telescope (MCAT)
- Debris Resistive Acoustic Grid Orbital NASA-Navy Sensor (DRAGONS) on ISS
- DebrisSat
• NASA is currently working with the Air Force and AFRL to deploy a new 1.3-m telescope on Ascension Island.

• The low latitude of the site will permit observations of low inclination debris at all altitudes.
  – Debris as small as 10 cm in GEO should be detectable.

• The telescope will ultimately operate autonomously.

• Operations will start in 2015.
Meter-Class Autonomous Telescope (MCAT)
• Purpose is to provide data on debris smaller than 1 mm
• DRAGONS combines dual-layer thin films and an acoustic sensor system with the resistive grid sensor system to create a COTS-based instrument that provides excellent semi-real-time impact detection and recording capability
  – Impact data includes: Impact time, impact flux, particle size, impact speed, impact direction, and impact energy
DRAGONS

- Two potential flight opportunities
  - ISS Technology Demonstration Office
  - DoD Space Test Program – higher altitude
• **NASA Standard Breakup Model**
  - Based on ground based hypervelocity impact tests and on-orbit fragmentations, explosion and collision
  - Ground based tests were on performed on 1960’s Transit satellite and simulated spacecraft & rocket bodies
    - No multilayer insulation (MLI) or solar panels
  - Iridium/Cosmos collision in 2009 showed differences between “new” and “old” construction

• **DebriSat**
  - Design and fabricate a 60-cm/50-kg class satellite, including MLI and solar panels, to be representative of modern payloads in LEO
  - Carry out a hypervelocity impact test with sufficient kinetic energy to completely breakup DebriSat
DebriSat

Multi-Layer Insulation

Deployable Solar Panels

Sun Sensor

Composite Body Panels

50 cm

50 cm

90 cm

30 cm

Spectrometer

X-band Antenna

S-band Antenna

Optical Imager

Divert Thruster

UHF/VHF Antenna

8.6 cm × 9 cm, 570 g
6.8 km/sec

July 2013
DebriSat

- DebriSat shot was successfully conducted on April 15th at Arnold Engineering Development Center (AEDC)
  - Projectile impacted DebriSat at 6.8 km/sec and completed fragmented the target
• To further increase the benefits of the project, Aerospace built a target resembling a launch vehicle upper stage ("DebrisLV") for the pre-test shot
  – DebrisLV: 17.1 kg, body dimensions ~ 88 cm (length) × 35 cm (diameter)
  – Pre-test shot was successfully conducted on April 1st
  – Projectile impacted DebrisLV at 6.9 km/sec and completed fragmented DebrisLV
DebriSat Test Shot

- AEDC always conducts a test shot prior to the main event
  - Opportunity to test emulated upper stage

598 g projectile @ 6.9 km/sec
On-Going Measurements

- **Radar**
  - HUSIR/HAX
  - Goldstone

- **UK InfraRed Telescope (UKIRT)**

- **Michigan Orbital DEbris Survey Telescope (MODEST)**

- **Magellan/Blanco/Bi-static**
On-Going Radar Measurements

• **Haystack Ultrawideband Satellite Imaging Radar (HUSIR) – X band**
  – Was down for several years for upgrade and bearing issues.
  – Resumed limited operations in Jan. 2014
  – 336 hours collected in FY 2014
  – Expect ~600 hrs in FY 2015

• **HAX**
  – 645 Hours collected since last IADC

• **Goldstone**
  – 87 hours collected since last IADC
On-Going Optical Measurements

- **MODEST (0.6 m)**
  - 1 week of survey observations late June 2014

- **Magellan (6.5 m)**
  - 2 nights May 27 and May 28 direct imaging for faint GEO object survey. 0.5 deg field of view. Both nights clear.

- **Blanco (4.0 m)**
  - 1 night June 24 with Dark Energy Camera (2 deg diameter field of view) for faint GEO object survey.

- **MODEST/Blanco/SST/USNO Multi-Static**
  - Coordinated survey observations with 3.5-m Space Surveillance Telescope (New Mexico, USA), 1.3-m telescope at USNO Flagstaff (Arizona, USA), and 0.6-m MODEST (Chile). Clear all sites.
On-Going IR Measurements

- **United Kingdom InfraRed Telescope (UKIRT)**
  - 3.8 m telescope
  - Mauna Kea, Hawaii (4200 m elevation)
  - Significant time dedicated to NASA Orbital Debris Observation

- **WFCAM (Wide Field CAMera) JHK**
  - 25 nights of data – April, May, June, 2014
  - 16 objects observed

- **WFCAM ZYJHK**
  - 26 Nights – Oct, Nov, Dec 2014
  - 24 objects observed

- **UIST (UKIRT Imaging Spectrometer) 1-2.5um spectra**
  - 6 nights of data – Aug, Sept 2014
  - 10 objects observed